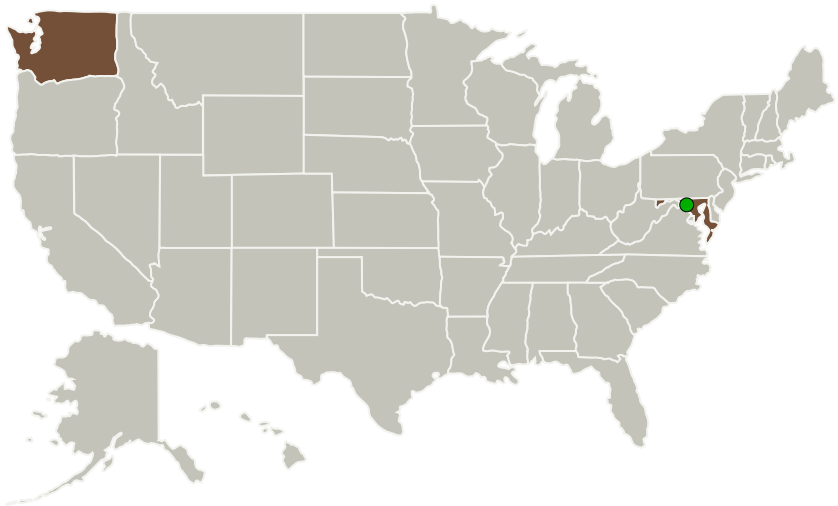
Ka-Band Electronically Steered CubeSat Antenna, Phase I

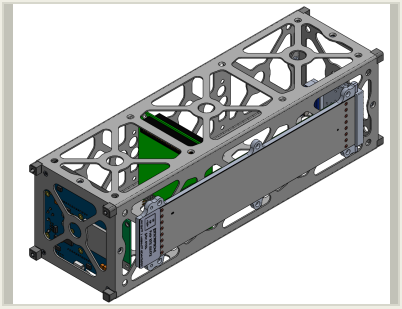
Completed Technology Project (2016 - 2016)

Project Introduction

Kymeta Government Solutions (KGS) recently designed, analyzed, built, tested, and delivered a small, lightweight, low-cost, low-power electronically steered prototype antenna for use on CubeSat antennas in low Earth orbit. Like all Kymeta/KGS metamaterial antenna systems, this antenna uses a tunable dielectric material and an array of radiating elements to create an interference pattern that steers the beam in the desired direction. This method provides moderate gain without the use of mechanical steering and similar functional performance to a traditional phased array at a fraction of the size, weight, power, and cost (SWAP-C). This prototype antenna meets RF performance goals but was designed as a proof of concept lab test unit with no environmental requirements. As a result, it needs a variety of minor modifications to be capable of surviving launch, to be capable of operating in the space atmosphere, and to better integrate into a CubeSat. This Phase I proposal focuses on the design of four updates to the antenna aperture to better meet requirements in the installed environment. Survivability during launch will be increased by a modification of the antenna-to-drive electronics connectors as well as the addition of two new bolts between the waveguide and radiating cell board; a redesign of the radiating cell will improve observed performance parameters during operation at temperature; and a modification of the waveguide will minimize the antenna footprint in a 3U CubeSat. If awarded, Phase I deliverables will include analysis and simulations of expected results, as well as a plan for fabrication and verification of the design during Phase II. If awarded Phase II, KGS would build and test the antennas designed in Phase I; if this testing indicates that the designs perform as expected based on analysis, the antenna itself would be ready to go to space.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Kymeta Government Solutions	Lead Organization	Industry	Redmond, Washington
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Maryland	Washington

Project Transitions

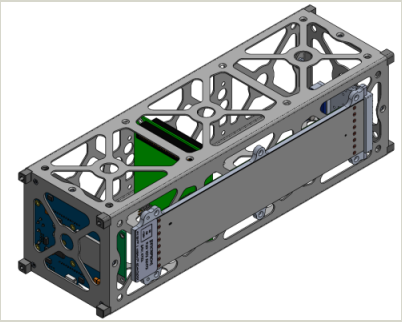
June 2016: Project Start

December 2016: Closed out

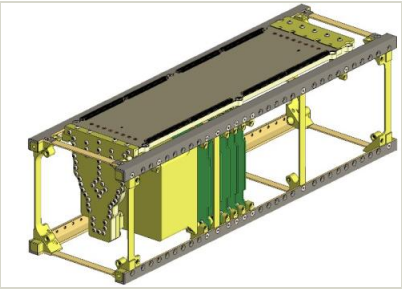
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140327)*

Images



Briefing Chart Image
Ka-Band Electronically Steered CubeSat Antenna, Phase I *(https://techport.nasa.gov/image/135674)*



Final Summary Chart Image
Ka-Band Electronically Steered CubeSat Antenna, Phase I Project Image *(https://techport.nasa.gov/image/127723)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Kymeta Government Solutions

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

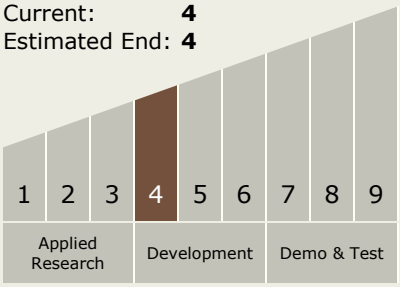
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Margaret R Godon

Technology Maturity (TRL)

Start: **4**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.2 Radio Frequency
    - TX05.2.6 Innovative Antennas

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System